

Rec'd FCT/PTO DEC 2004

**(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)**

**(19) World Intellectual Property  
Organization  
International Bureau**



**(43) International Publication Date**  
**8 January 2004 (08.01.2004)**

## PCT

**(10) International Publication Number**  
**WO 2004/003343 A1**

- (51) **International Patent Classification<sup>7</sup>:** E21B 49/00, G01N 33/28

(21) **International Application Number:** PCT/EP2003/006414

(22) **International Filing Date:** 17 June 2003 (17.06.2003)

(25) **Filing Language:** English

(26) **Publication Language:** English

(30) **Priority Data:** 02254596.6 28 June 2002 (28.06.2002) EP

(71) **Applicant (for all designated States except CA, US):** SHELL INTERNATIONAL RESEARCH MAATSCHAPPIJ B.V. [NL/NL]; Carel van Bylandtlaan 30, NL-2596 HR The Hague (NL).

(71) **Applicant (for CA only):** SHELL CANADA LIMITED [CA/CA]; 400 - 4th Avenue S.W., Calgary, Alberta T2P 2H5 (CA).

(72) **Inventor; and**

(75) **Inventor/Applicant (for US only):** COENEN, Josef, Guillaume, Christoffel [NL/NL]; Volmerlaan 8, NL-2288 GD Rijswijk (NL).

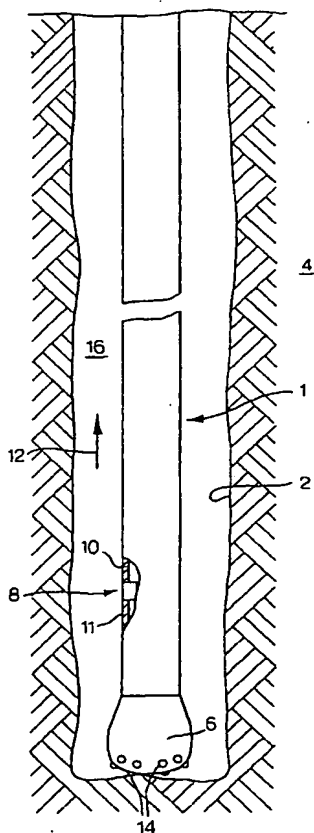
(74) **Agent:** SHELL INTERNATIONAL B.V.; Intellectual Property Services, P.O. Box 384, NL-2501 CJ The Hague (NL).

(81) **Designated States (national):** AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) **Designated States (regional):** ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),

*[Continued on next page]*

**(54) Title: SYSTEM FOR DETECTING GAS IN A WELLBORE DURING DRILLING**



**(57) Abstract:** A system is provided for detecting the presence of formation gas in a stream of drilling fluid flowing through a wellbore during drilling of the wellbore. The system comprises at least one sensor chamber connectable to a drill string for drilling the wellbore, each sensor chamber containing a volume of a selected gas and having a membrane wall which allows passage of formation gas from the stream of drilling fluid into the sensor chamber. The sensor is arranged to detect a change of a selected characteristic of said volume of gas due to passage of formation gas from the stream of drilling fluid via the membrane wall into the sensor chamber.

**WO 2004/003343 A1**



European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**Published:**

— *with international search report*

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 03/06414

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 E21B49/00 G01N33/28

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, TULSA, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 469 917 A (WOLCOTT DUANE K) 28 November 1995 (1995-11-28) column 2, line 55 -column 3, line 6 column 3, line 24-45 column 3, line 58-62 figures 1,4 ---	1
A	US 5 351 532 A (HAGER ROBERT N) 4 October 1994 (1994-10-04) column 6, line 36-65 ---	1
A	WO 01 98630 A (SCHLUMBERGER CA LTD ;SCHLUMBERGER SERVICES PETROL (FR); JONES TIMO) 27 December 2001 (2001-12-27) the whole document --- -/--	1

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

10 September 2003

Date of mailing of the international search report

17/09/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Schouten, A

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/EP 03/06414

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 01 63094 A (SCHLUMBERGER HOLDINGS; SCHLUMBERGER SERVICES LTD; SCHLUMBERGER DE PERFI) 30 August 2001 (2001-08-30) the whole document ---	1
A	A.O. BRUMBOIU ET AL: "Application of Semipermeable Membrane Technology in the Measurement of Hydrocarbon Gases in Drilling Fluids" SPE # 62525, 19 June 2000 (2000-06-19), pages 1-12, XP002220474 the whole document ---	1
A	DENNIS E. DRIA: "MEMBRANE-BASED GAS SENSING FOR ROBUST PAY IDENTIFICATION" 42ND ANNUAL SPWLA LOGGING SYMPOSIUM, 17 June 2001 (2001-06-17), pages 1-6, XP008010019 Houston, Texas the whole document ---	1
A	US 4 887 464 A (TANNENBAUM ELI ET AL) 19 December 1989 (1989-12-19) column 1, line 57-61 -----	1

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 03/06414

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5469917	A	28-11-1995	NONE	
US 5351532	A	04-10-1994	WO 9509971 A1	13-04-1995
WO 0198630	A	27-12-2001	GB 2363809 A	09-01-2002
			AU 7421901 A	02-01-2002
			WO 0198630 A1	27-12-2001
			NO 20026041 A	19-12-2002
WO 0163094	A	30-08-2001	GB 2359631 A	29-08-2001
			AU 3211101 A	03-09-2001
			WO 0163094 A1	30-08-2001
			NO 20024003 A	22-08-2002
			US 2003134426 A1	17-07-2003
US 4887464	A	19-12-1989	DE 68918408 D1	27-10-1994
			EP 0370548 A1	30-05-1990
			NO 894367 A ,B,	23-05-1990